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10/598,663	09/07/2006	Andy Ziegler	PHDE040070US	8637

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EXAMINER	
TANINGCO, ALEXANDER H	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	**Application No.** 10/598,663	**Applicant(s)** ZIEGLER, ANDY
	Examiner ALEXANDER H. TANINGCO	**Art Unit** 2882

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 August 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3 and 5-21* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3 and 5-21* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

Amendments filed 08/12/2008 have been entered.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-3, 5, 6, 8, and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Elbakri et al. (US 6,507,633) in view of Liew et al. (Noise propagation in SPECT images reconstructed using iterative maximum-likelihood algorithm).

With regards to claim 1, Elbakri et al. disclose a method comprising the step of: reconstructing an image of the object of interest on the basis of the data set (Col. 5 Lines 41-45); wherein a statistical weighing is performed during reconstruction of the image (Col. 5 Lines 54-56); wherein the reconstruction of the image is performed on the basis of an iterative algorithm (Col. 8 Lines 20-22) comprising a plurality of update steps until an end criterion has been fulfilled (Col. 5 Lines 65-67), wherein each update step comprises subtractions weighted (Col. 9 Lines 1-10 and Col. 14 Lines 40-50). Elbakri et al. fail to teach an intrinsic statistical error σ_{Y_i} based on measured photon counts Y_i, wherein σ_{Y_i} is the square root of Y_i.

Liew et al. teach an intrinsic statistical error σ_{Y_i} based on measured photon counts Y_i, wherein σ_{Y_i} is the square root of Y_i (Abs. Lines 11-13 and page 1717 Lines 18-24). It would have been obvious to one of ordinary skill in the art, at the time of invention to modify the invention of Elbakri et al., to include the effect of photon noise as taught by Liew et al., since one would have been motivated to make such a modification to reduce noise thus improving image quality as taught by Liew et al. (Abs.).

With regards to claim 2, Elbakri et al. as modified above disclose a method comprising a step wherein the data set is a projection data set acquired by means of a source of electromagnetic radiation generating a beam and by means of a radiation detector detecting the beam (Col. 5 Lines 55-59; Fig. 1).

With regards to claim 3, Elbakri et al. as modified above disclose a method comprising a step wherein the source of electromagnetic radiation is a polychromatic x-ray source (Col. 5 Line 58); wherein the source moves along a helical path around the object of interest (Col. 1 Line 51); and wherein the beam has one of a cone beam geometry and a fan beam geometry (Col. 1 Lines 48-54).

With regards to claim 5, Elbakri et al. as modified above disclose a method comprising a step wherein the iterative algorithm is a maximum likelihood algorithm (Col. 8 Line 21); wherein the reconstructed image has the highest likelihood (Col. 8 Line 21); and wherein the weighing is performed in each update step of the plurality of update steps (Col. 8 Line 59 – Col. 9 Line 55).

With regards to claim 6, Elbakri et al. as modified above disclose a method comprising the step of: determining a number of detected photons during acquisition of

the data set (Col. 8 Lines 13-15); wherein the weighing is based on a statistical error of the number of detected photons (Col. 14 Lines 45-50).

With regards to claim 8, Elbakri et al. as modified above disclose a method comprising a step wherein the reconstruction of the image is based on a sub-set of at least two projections of all acquired projections of the projection data set (Col. 5 Lines 61-63).

With regards to claim 13, Elbakri et al. as modified above disclose wherein the end criterion is met only when a difference between consecutive updates does not exceed a threshold value, wherein the threshold value is defined; wherein if the end criterion is not met a counter is increased by one and iterations continue (Col. 19 Line 63 – Col. 20 Line 4).

Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Elbakri et al. (US 6,507,633) and Liew et al. (Noise propagation in SPECT images reconstructed using iterative maximum-likelihood algorithm) as applied to claim 5 above, and further in view of Lange et al. (Globally Convergent Algorithms for Maximum a Posteriori Transmission Tomography).

With regards to claim 7, Elbakri et al. disclose a method as recited above in claim 5. Elbakri et al. teach a method comprising maximum likelihood and Poisson distribution (Col. 8 Lines 1-24; Col. 11 Line 21 – Col. 12 Line 15; Equations 9 and 10-28). Elbakri et al. as modified above disclose determining a number of detected photons Y_i **N** during acquisition of the data set (page 1717 Lines 18-19 Liew et al.); wherein the weighing is based on a statistical error σ_{Y_i} of the number of detected

photons Y_i (page 1717 Lines 22-24 Liew et al.); wherein an update of an attenuation parameter (page 1717 Lines 5-15 Liew et al.). Elbakri et al. as modified above fail to explicitly teach wherein an update of an attenuation parameter μ_j^{n+1} is calculated from the attenuation parameter μ_j^n by

$$= \mu_j^n \frac{\sum_i l_{ij}\left[d_i e^{-\langle l_i, \mu^n \rangle}\left(1 + \langle l_i, \mu^n \rangle\right) - Y_i\right]}{\sum_i l_{ij} \langle l_i, \mu^n \rangle d_i e^{-\langle l_i, \mu^n \rangle}},$$

wherein d_i is a number of photons emitted by the source of radiation;

wherein l_{ij} is a basis function of an i-th projection;

wherein l_i is a vector of basis functions l_{ij} of the i-th projection;

and wherein $\langle l_i, \mu \rangle = \sum_j l_{ij} \mu_j$ is an inner product.

Lange et al. teach a method comprising the step of: determining a number of detected photons Y_i during acquisition of the data set; wherein an update of an attenuation parameter μ_j^{n+1} is calculated from the attenuation parameter μ_j^n by

$$= \mu_j^n \frac{\sum_i l_{ij}\left[d_i e^{-\langle l_i, \mu^n \rangle}\left(1 + \langle l_i, \mu^n \rangle\right) - Y_i\right]}{\sum_i l_{ij} \langle l_i, \mu^n \rangle d_i e^{-\langle l_i, \mu^n \rangle}}.$$

(Equations 1-7). It would have been obvious to one of ordinary skill in the art, at the time of invention to modify the invention of Elbakri et al. to include the featues of Lange et al. One would have been motivated to make such a modification to reduce artifacts thus improving image quality as implied by Lange et al.

Claims 9-13 and 18-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Elbakri et al. (US 6,507,633) in view of August (US 2003/0219152)

and Liew et al. (Noise propagation in SPECT images reconstructed using iterative maximum-likelihood algorithm).

With regards to claims 9, 11, and 12, Elbakri et al. disclose a data processing device, comprising: a memory for storing a data set of an object of interest (Fig. 1); a data processor for performing artifact correction in the data set of the object of interest, wherein the data processor is adapted for performing the following operation (Fig. 1; Abs.): reconstructing an image of the object of interest on the basis of the data set (Fig. 1; Col. 5 Lines 41-45); wherein a statistical weighing is performed during reconstruction of the image (Col. 5 Lines 54-56; Fig. 1). Elbakri et al. fail to explicitly teach an apparatus wherein a data processor is adapted for performing the following operation: loading the data set; and wherein the weighting comprises an intrinsic statistical error σ_{Y_i} based on measured photon counts Y_i, wherein σ_{Y_i} is the square root of Y_i.

August teaches an apparatus wherein a data processor is adapted for performing the following operation: loading the data set [0050; Fig 2 note: **50**]. It would have been obvious to one of ordinary skill in the art, at the time of invention to modify the invention of Elbakri et al. to include a computer readable medium as taught by August. One would have been motivated to make such a modification to more easily update existing systems to implement the invention as implied by August.

Liew et al. teach an intrinsic statistical error σ_{Y_i} based on measured photon counts Y_i, wherein σ_{Y_i} is the square root of Y_i (Abs. Lines 11-13 and page 1717 Lines 18-24). It would have been obvious to one of ordinary skill in the art, at the time of invention to further modify the invention of Elbakri et al., to include the effect of photon

noise as taught by Liew et al., since one would have been motivated to make such a modification to reduce noise thus improving image quality as taught by Liew et al. (Abs.)

With regards to claim 10, Elbakri et al. as modified above disclose a data processing device wherein the reconstruction of the image is performed on the basis of an iterative algorithm comprising a plurality of update steps until an end criterion has been fulfilled (Abs.); wherein the iterative algorithm is a maximum likelihood algorithm; wherein the reconstructed image has the highest likelihood (Col. 8 Line 21); and wherein the weighing is performed in each update step of the plurality of update steps (Col. 8 Line 59 – Col. 9 Line 55).

With regards to claim 18, Elbakri et al. as modified above disclose wherein the processor also determines a number of detected photons during acquisition of the data set (Col. 7 Lines 60-64).

With regards to claim 19, Elbakri et al. as modified above disclose wherein the processor further sets a set of attenuation parameters μ_j to an initial value, wherein each attenuation parameters μ_j belongs to a respective interval along a projection of an i-th projection (Col. 1 Line 65 – Col. 2 Line 11).

With regards to claim 20, Elbakri et al. as modified above disclose wherein the processor further calculates the attenuation parameters μ_j by:

$$= \mu_j^n \frac{\sum_i l_{ij}\left[d_i e^{-\langle l_i, \mu^n \rangle}\left(1 + \langle l_i, \mu^n \rangle\right) - Y_i\right]}{\sum_i l_{ij} \langle l_i, \mu^n \rangle d_i e^{-\langle l_i, \mu^n \rangle}},$$

wherein d_i is a number of photons emitted by the source of radiation;

wherein l_{ij} is a basis function of an i-th projection;

wherein l_i is a vector of basis functions l_{ij} of the i-th projection;

and wherein $<l_i,\mu>=\sum_j l_{ij}\mu_j$ is an inner product (Col. 5 Lines 54-56 Elbakri et al. and Abs. Lines 11-13 and page 1717 Lines 18-24 Liew et al.).

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Elbakri et al. (US 6,507,633) in view of August (US 2003/0219152) and Liew et al. (Noise propagation in SPECT images reconstructed using iterative maximum-likelihood algorithm) as applied to claim 11 above, and further in view of Van Stevendaal et al. (US 2007/0019782).

With regards to claim 14, Elbakri et al. as modified above disclose an apparatus as recited above in claim 11. Elbakri et al. as modified above fail to teach wherein the CT scanner is connected to a loudspeaker to automatically output an alarm. Van Stevendaal et al. teach wherein the CT scanner is connected to a loudspeaker to automatically output an alarm [para 0048]. It would have been obvious to one of ordinary skill in the art, at the time of invention to modify the invention of Elbakri et al. to include the features of Van Stevendaal et al, to improve data acquisition as implied by Van Stevendaal et al. [para 0048].

Claims 15 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Elbakri et al. (US 6,507,633), August (US 2003/0219152), and Liew et al. (Noise propagation in SPECT images reconstructed using iterative maximum-likelihood

algorithm) as applied to claim 12 above, and further in view of Simon et al. (US 2002/0154735).

With regards to claim 15, Elbakri et al. as modified above disclose an apparatus as recited above in claim 12. Elbakri et al. as modified above fail to explicitly teach wherein the apparatus is connected to a memory for storage of an image depicting an object of interest. Simon et al. teach wherein the apparatus is connected to a memory **304** for storage of an image depicting an object of interest [para 0035]. It would have been obvious to one of ordinary skill in the art, at the time of invention to modify the invention of Elbakri et al. to include a memory for storage as taught by Simon et al., since one would have been motivated to make such a modification to improve data processing as implied by Simon et al. [para 0033].

With regards to claim 16, Elbakri et al. as modified above disclose an apparatus as recited above in claim 12. Elbakri et al. as modified above disclose a display means (Col. 6 Lines 19-20). Elbakri et al. as modified above fail to explicitly teach wherein the apparatus is connected to a plurality of input/output network and diagnostic devices for further analysis. Simon et al. teach wherein the apparatus is connected to a plurality of input/output network **315** and diagnostic devices for further analysis **120** [para 0004 and 0033]. It would have been obvious to one of ordinary skill in the art, at the time of invention to modify the invention of Elbakri et al. to include a memory for storage as taught by Simon et al., since one would have been motivated to make such a modification to improve data processing as implied by Simon et al. [para 0033].

Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Elbakri et al. (US 6,507,633), August (US 2003/0219152), and Liew et al. (Noise propagation in SPECT images reconstructed using iterative maximum-likelihood algorithm) as applied to claim 12 above, and further in view of Eisenberg et al. (US 2003/0128801).

With regards to claim 17, Elbakri et al. as modified above disclose an apparatus as recited above in claim 12. Elbakri et al. as modified above fail to teach wherein the apparatus is further connected to a motion monitor which may monitor the physiological capacities of an object of interest. Eisenberg et al. teach wherein the apparatus is further connected to a motion monitor which may monitor the physiological capacities of an object of interest [0053]. It would have been obvious to one of ordinary skill in the art, at the time of invention to modify the invention of Elbakri et al., to include the features of Eisenberg et al., since one would have been motivated to make such a modification to improve data acquisition as taught by Eisenberg et al. [para 0053].

Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Elbakri et al. (US 6,507,633), August (US 2003/0219152), and Liew et al. (Noise propagation in SPECT images reconstructed using iterative maximum-likelihood algorithm) as applied to claim 12 above, and further in view of Fessler (US 2003/0156684).

With regards to claim 21, Elbakri et al. as modified above disclose an apparatus as recited above in claim 12. Elbakri et al. disclose ordered subsets are used

to accelerate convergence (Col. 6 Lines 21-25). Elbakri et al. as modified above fail to explicitly teach wherein the reconstruction of the image is based on a sub-set of at least two projections of all acquired projections of the projection data set. Fessler teaches wherein the reconstruction of the image is based on a sub-set of at least two projections of all acquired projections of the projection data set [para 0028]. It would have been obvious to one of ordinary skill in the art, at the time of invention to modify the invention of Elbakri et al. to include the features of Fessler, since would would have been motivated to make such a modification to accelerate convergence thus improving computational speed as taught by Fessler [para 0289].

Response to Arguments

Applicant's arguments, see page 12, filed 08/12/2008, with respect to specification objection have been fully considered and are persuasive. The objection of the specification has been withdrawn.

Applicant's arguments, see page 12, filed 08/12/2008, with respect to claim 12 have been fully considered and are persuasive. The rejection of claim 12 has been withdrawn.

Applicant's arguments with respect to claims 1-3 and 5-21 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The following patents are cited to further show:

Stanton et al. (US 6,744,848) shows image processor then determines if the convergence criteria are satisfied in step 282. If the convergence criteria are not satisfied, the image processor returns to step 268. If the convergence criteria are satisfied, the image processor stores and displays the 3D model density in step 284. Convergence criteria are well known to those skilled in the art of 3D reconstructions (Col. 18 Lines 5-16).

Wu et al. (NPL) ML-EM reconstruction technique (page 371 equation 7)

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ALEXANDER H. TANINGCO whose telephone number is (571)272-8048. The examiner can normally be reached on Mon-Fri 8:00-4:30 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ed Glick can be reached on (571) 272-2490. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Alexander H Taningco/
Examiner, Art Unit 2882

/Edward J Glick/
Supervisory Patent Examiner, Art Unit 2882